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U S NAVY RESPONSE TO SOUTH CAROLINA DEPARTMENT OF HEALTH AND
ENVIRONMENTAL CONTROL COMMENTS TO RCRA FACILITY INVESTIGATION REPORT
ADDENDUM SOLID WASTE MANAGEMENT UNIT 163 (SWMU 163) RCRA FACILITY
INVESTIGATION REMEDIAL ACTION AND SOLID WASTE MANAGEMENT UN
11/11/2003
CH2M HILL

SWMU 163/166 Zone K
R-LC on SWMU 163 RFIRA + SWMU 166 RFIRA

CH2MHILL TRANSMITTAL

To: David Scaturo
South Carolina Department of Health
and Environmental Control
Bureau of Land and Waste
Management
8901 Farrow Road
Columbia, SC 29203

From: Dean Williamson/CH2M-Jones

Date: Nov. 11, 2003

Re: CH2M-Jones' Responses to Comments by SCDHEC regarding the *RFI Report Addendum, SWMU 166, Zone K, Revision 0*, originally submitted on January 11, 2002, and *RFI Report Addendum, SWMU 163, Zone K, Revision 0*, originally submitted on March 22, 2002

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This document presents CH2M-Jones' responses to the South Carolina Department of Health and Environmental Control's (SCDHEC's) comments regarding CH2M-Jones' February 2003 responses to SCDHEC comments on the *RCRA Facility Investigation (RFI) Report Addendum, Revision 0, SWMU 166, Zone K* (CH2M-Jones, January 2002) and the *RFI Report Addendum, Revision 0, SWMU 163, Zone K* (CH2M-Jones, March 2002).

Comments Prepared by Jo Cherie Overcash, July 3, 2003

General Comments

Comment:

1. Noteworthy is that the Navy has not responded to the first 14 comments forwarded by Paul Bergstrand (7/30/02) of this Division regarding the *CMS Report, MIP Phase II Pilot Study, Revision 0, SWMU 166 Zone K* (CH2M-Jones, January 2002). The Navy states that these comments will be addressed under separate cover but the Navy has not provided a timeframe for that submittal. During implementation of the interim measure to address the volatile organic compound (VOC) contamination in groundwater, the Navy made a decision to address the entire Naval Annex under the auspices of SWMU 166. As a result, and rightly so, a comprehensive view of the groundwater situation at the Naval Annex has been taken by this Division. For purposes of the RFI and implementation of any remedy (interim or final) at the Naval Annex, groundwater investigation and remedy should address the entire site. In reality, the groundwater issues at Zone K Naval Annex cannot be divided between the solid waste management units but should be viewed as a whole. Therefore, the Navy should respond to Bergstrand's comments prior to submittal of revised RFI Reports Addendum so that this Division can conduct a comprehensive review of the issues at Zone K Naval Annex. See Bergstrand Comment 16.

CH2M-Jones Response:

CH2M-Jones believes it is not necessary to respond to the 14 comments made by Paul Bergstrand (July 30, 2002) based on his review of the Corrective Measures Study (CMS) Report, Membrane Interface Probe (MIP) Phase II Pilot Study (CH2M-Jones, January 2002). The use of the data collected during the vertical profile/MIP investigation was not to characterize the nature and extent of contamination at SWMU 166 and the Naval Annex, and as a result, the data have no impact on the conclusions drawn in the RFI Report Addendums for SWMUs 163 and 166. The investigation to define the nature and extent of the chlorinated volatile organic compound (CVOC) plume at the Naval Annex was conducted in accordance with the Zone K RFI Work Plan Addendum, Revision 1 (CH2M-Jones, March 2001).

The data collected during the vertical profile/MIP investigation were used as a tool to define area(s) of elevated concentration(s) that would be targeted for active corrective measures. The groundwater data collected from the vertical profile points were used to compare results from the laboratory to the electron capture detector (ECD) data during the CMS pilot study.

Trichloroethene (TCE) and cis-1,2-dichloroethene (cis-1,2-DCE) data from the samples collected from the 38 vertical profiler points advanced at SWMU 166 (i.e., K166VP001 through K166VP038) and from the 19 vertical profiler points advanced at SWMU 163 (i.e.,

K163VP003 through K163VP021) will be added to Figures 4-2 through 4-5 from the RFI Report Addendum, Revision 0, SWMU 163, Zone K (CH2M-Jones, March 2002) and from the RFI Report Addendum, Revision 0, SWMU 166, Zone K (CH2M-Jones, January 2002). In addition, TCE and cis-1,2-DCE data from the samples collected from shallow and deep monitoring wells (i.e., K166GW33D through K166GW39D, K166GW040, and K166GW41D through K166GW52D) installed as part of the interim measure (IM) at SWMU 166 will be included in these figures.

Comment:

2. Determination Of The Vertical Extent Of Contamination

Bergstrand 15, 22, 24, 30 AND 32; OVERCASH 1

In the SWMU 163 document, the boring depths and sampling depths are given as "below land surface". The Navy has agreed to modify Figures 4-2 through 4-7 of the SWMU 163 document and Figures 4-2 through 4-5 of the SWMU 166 document to depict sampling intervals as "mean sea level".

Moreover, the SWMU 163 document did not include a top of the Ashley Formation figure to include the western portion of the Zone K Naval Annex. The Navy responded that a "structure contour map of the top of the Ashley Formation including the area west and south of SWMU 163" will be provided for the SWMU 163 document and a replacement figure will be provided for the SWMU 166 document."

The Navy should revise the RFI Reports Addendum as proposed. The Division of Hydrogeology will use the revised Figures to aid in determining whether the investigation of the vertical extent is complete. Based on available data, this Division does not agree with the Navy's conclusion that the vertical extent has been adequately investigated. Note that additional investigation may be warranted based on a review of the revised Report.

CH2M-Jones Response:

Figures 4-2 through 4-7 from the RFI Report Addendum, Revision 0, SWMU 163, Zone K (CH2M-Jones, March 2002) and Figures 4-2 through 4-5 from the RFI Report Addendum, Revision 0, SWMU 166, Zone K (CH2M-Jones, January 2002) will be modified to show sample collection depths of geoprobe and vertical profiler point samples in feet mean sea level (ft msl) instead of feet below land surface (ft bls).

A figure will be added to the RFI Report Addendum for SWMU 163 that presents a structural contour map of the top of the Ashley Formation, including the area west and south of SWMU 163. This figure will replace the top of the Ashley Formation figure (i.e., Figure 2-1) presented in the RFI Report Addendum, Revision 0, SWMU 166, Zone K (CH2M-Jones, January 2002).

Comment:

3. Determination Of The Horizontal Extent Of Contamination

Bergstrand Comments 15, 28, 30, and 32; Overcash Comment 1 and 15

Throughout the referenced Response to Comments, the Navy states that a corrective measures study (CMS) will be submitted to address the offsite migration of the groundwater contaminant plume in concentrations that exceed the MCL. Note that the Navy has not provided a timeframe for this submittal.

Moreover, the Navy's response regarding the migration of the groundwater contaminant plume beyond the southeastern property boundary is inadequate. The Navy's response to address offsite contamination following review of the Interim Measure Completion Report (IMCP) is inadequate in that an evaluation of the effectiveness of the zero-valent iron (ZVI) injections at the 8 identified "hot spots" will not enable the Navy to determine the extent of the groundwater plume off site. While remediation of a potential source area should have an effect on the downgradient concentration of the VOCs, that effect will not be immediate and cannot aid in determining the extent of contamination at this time.

Specifically, the geoprobe monitoring location K166GP106 is approximately 214 feet south of the southeastern property boundary. According to the facility's geographic information system (GIS) database, in May 2001 tetrachloroethene (PCE) was detected at the 10 foot below land surface interval at a concentration of 351.0 micrograms per liter ($\mu\text{g/L}$) and at the 15 foot interval the concentration was reported as 486.0 $\mu\text{g/L}$. At the same time, trichloroethene (TCE) was detected at these same intervals at concentrations of 21.9 $\mu\text{g/L}$ and at 47.2 $\mu\text{g/L}$ respectively. PCE and TCE exceed their MCL of 5 $\mu\text{g/L}$. Noteworthy is that K166GP106 is located approximately 620 feet south of TTA 5 and 560 feet south of TTA 6. Remediation in those TTA "hot spots" will not have an effect on groundwater quality in the vicinity of K166GP106 due to distance.

Note that the Navy has chosen not to install permanent offsite monitoring wells to verify the detection of VOCs at the direct push technology (DPT) locations to the southeast of the site. Rather the Navy states that they will identify the existing monitoring locations in the southeastern portion of the site to be used for long term groundwater monitoring. Before a final remedial decision can be made, the Navy must determine the extent of the groundwater contaminant plume in both the southwestern and southeastern portions of the Zone K Naval Annex. See Specific Comment below regarding a request to install permanent monitoring wells in the southwestern portion of the Zone K Naval Annex.

CH2M-Jones Response:

The Navy agrees that due to the large areal extent of SWMU 166 and the relatively distant location of the contaminant source areas from the boundaries of the dissolved plume of CVOCs on the southeastern side, the effect of source remediation will not have an immediate impact on the boundary of the dissolved plume. However, the Navy believes that TCE and tetrachloroethene (PCE) detected in the samples collected from K166GP006 are not related to former operations on the Naval Annex property, since the detected CVOC concentrations from the offsite sample location that is adjacent to other offsite facilities appears to be isolated.

While TCE and PCE were detected at K166GP006 above their respective MCLs during the May 2001 sampling, upgradient shallow monitoring wells K166GW004 and K166GW008, which are closer to the source areas, historically have not shown PCE detections above laboratory detection limits. TCE concentrations in these two wells have been either below laboratory detection limits or below the MCL of 5 µg/L (please refer to Figure 4-2). Additionally, TCE concentrations in shallow well K166GW018, which is northwest of K166GP006 (and also hydrologically upgradient), showed PCE detections of 44 µg/L and 35 µg/L during the 1998 sampling events, followed by a detection of 6 µg/L during the September 1999 sampling event. TCE detections in this well were below the MCL.

The detections of TCE and PCE at K166GP006 above MCLs are likely a result of impact from offsite sources near Interstate 26. These offsite sources are not being investigated as part of the SWMU 166 RFI and do not warrant further evaluation.

For the shallow aquifer on the southeastern side of the SWMU 166 area, wells K166GW004, K166GW008, and K166GW017 are adequate to monitor the threat of offsite contaminant migration from SWMU 166, since the contaminant source areas related to SWMU 166 are upgradient of these wells.

For the deeper aquifer on the southeastern side of the SWMU 166 area, wells K166GW04D, K166GW08D, K166GW11D, K166GW12D, and K166GW17D are adequate to monitor the threat of offsite contaminant migration from SWMU 166.

No additional wells on the southeastern side of SWMU 166 or the Naval Annex property are recommended to monitor potential offsite contaminant migration.

Comment:

**4. Determination Of The Effectiveness of Groundwater Interim Measure
Bergstrand 15, 28, AND 32; OVERCASH 3 AND 13**

The Navy has implemented an interim measure (IM) for groundwater across Zone K Naval Annex utilizing the FeroxSM technology as an in-situ subsurface remediation process to treat the volatile organic compounds (VOCs) and metals. In the January 2002 *Interim Measure Work Plan*, SWMU 166, the Navy identified 8 target treatment areas (TTAs) as "hot spots". At the time of approval (Bergstrand to Daniell, 5/8/02), this Division stated that downgradient monitoring locations should be installed to monitor the effectiveness of the groundwater IM. Moreover, Overcash Comment 3 and Comment 13 of this review also stated that the Navy must propose to install a sufficient number of properly spaced permanent shallow and deep monitoring wells specifically downgradient of SWMU 163 and TTA 8.

The Navy has decided not to install these monitoring wells. In response the Navy states that the Navy/CH2M-Jones team will evaluate the IM data and determine whether the existing monitoring well network is adequate to monitor downgradient plume migration.

This Division takes exception to this approach in that this Division evaluated the existing groundwater monitoring network prior to approval of the IM and found that adequate monitoring locations did not exist, as pointed out above. According to the facility's Underground Injection Control Permit Application (Beisel to Adams, 1/29/02),

the assumed radial influence for each ZVI injection point was given as 20 feet. It is unclear as to how the Navy anticipated determining the effectiveness of this IM without monitoring within and beyond the assumed 20 foot radial influence at each TTA.

In the absence of adequate downgradient monitoring locations, groundwater quality beyond the expected 20 foot radial zone of influence will be viewed as if no remediation has been implemented. In the absence of downgradient data collected prior to injection of the ZVI, this Division will regard groundwater quality as unaffected outside those radial zones of influence. It is understood that an IMCR is to be submitted in August 2003. A thorough review of the IMCR will be conducted. In the meantime, the Navy must install the monitoring wells along the southwestern portion of the site to monitor the migration of the groundwater plume beyond the facility boundary.

CH2M-Jones Response:

The Navy/CH2M-Jones team evaluated the adequacy of monitoring wells outside and downgradient of the TTAs. Specifically, new wells K166GW038D, K166GW44D, and K166GW50D were installed prior to the IM to monitor potential migration of contaminants downgradient of TTA1, TTA2, TTA3, TTA4 and TTA5. Three nested pairs of shallow/deep wells exist downgradient of TTA6. Contaminant delineation around TTAs 7 and 8 were adequately completed during the RFI and contamination was found to be localized.

The locations of new and existing wells in relation to the TTAs were provided to SCDHEC as part of the well installation request. The monitoring wells within and downgradient of the TTAs were sampled prior to and after the zero-valent iron (ZVI) injections. The data from these monitoring events will be provided as part of the Interim Measure Completion Report (IMCR).

The evaluation of the effectiveness of the IM is beyond the scope of the RFI. At the present time, the effectiveness of the ZVI injection is still being evaluated and issues noted above will be addressed more thoroughly as part of the IMCR and the CMS Report for SWMU 166.

In response to this comment, a well installation request for two additional deep wells, identified as KGDKGW03D and KGDKGW04D, in the southwest portion of Zone K was submitted to SCDHEC in a letter dated July 21, 2003. The well installation request was approved by SCDHEC and approval was provided on July 31, 2003. These wells were installed on October 3, 2003. Monitoring wells KGDKGW03D and KGDKGW04D were installed to a termination depth of approximately 40 and 43 ft bls, respectively..

Specific Comments

Comment:

5. Geologic Cross Sections

Bergstrand Comment 21 and 24 plus Overcash Comment 1

It is unclear as to the number of geologic cross sections to be provided as well as to its orientation. According to Section II entitled RCRA Facility Investigation (RFI) Requirements of Appendix B included in the facility's RCRA Permit, the Navy must provide "data of adequate technical content" during the RFI investigation. Due to the comprehensive approach to Zone K Naval Annex, the numerous "source" areas and the complexity of the geology and groundwater flow regime, the Navy must provide an

adequate number of geologic cross sections to depict the Naval Annex. For example, the geologic cross sections should include the hydrogeologic units, groundwater elevation, vertical gradients, the monitoring wells and their screened intervals. Geologic cross sections should be constructed parallel and perpendicular to groundwater flow and consideration should be given to the 8 target treatment areas (TTAs) that have been identified. See the referenced Section II of Appendix B of the RCRA Permit for pertinent details.

CH2M-Jones Response:

Three lithologic cross sections of the Naval Annex will be constructed using well log geologic descriptions of the subsurface collected during the original RFI activities and new geologic data collected subsequent to the Zone K RFI Report (EnSafe, June 1999). These lithologic cross sections will be included as Figures 2-1 through 2-3 in the RFI Report Addendum, Revision 1 for both SWMU 163 and SWMU 166. Lithologic cross section A-A' (Figure 2-1) transverses the entire Naval Annex, initiating at the western portion of the property and terminating east of Interstate 26. Lithologic cross sections B-B' (Figure 2-2) and C-C' (Figure 2-3) transverse perpendicular (i.e., northwest to southeast) to cross section A-A' through the western and eastern sections, respectively, of the Annex property.

Comment:

6. Monitoring Well Request

Bergstrand Comment 22 and Overcash Comment 2

In response, the Navy agreed to install permanent shallow and/or deep monitoring wells along the southwestern property boundary and stated that due to the number of existing wells in the southeastern portion of the Naval Annex, no additional wells will be proposed in that area.

On May 30, 2003, the author called for the Navy (Overcash to Hudson of CH2M-Hill) to submit the request to install permanent shallow and deep monitoring wells along the southwestern property boundary as proposed and to identify the existing monitoring wells in the eastern portion of the site that would be appropriate for continued monitoring. Almost 30 days have past and the Navy has not submitted the proposed monitoring well request. The Navy should immediately (within 10 days of receipt of this correspondence) submit a request to install a number of properly located monitoring wells in the southwestern portion of the Naval Annex, to include identification of off site locations.

CH2M-Jones Response:

In a July 21, 2003 letter addressed to Ms. Jo Cherie Overcash, CH2M-Jones requested the installation of two deep groundwater monitoring wells in the southwestern portion of the Naval Annex. These proposed monitoring well locations, identified as KGDKGW03D and KGDKGW04D, are designed to evaluate potential offsite migration of chlorinated solvents near the southwestern property boundary. SCDHEC subsequently approved the request in a letter dated July 31, 2003.

Comment:

7. Charleston Air Force Base
Overcash Comment 5

This Division disagrees with the Navy's conclusion that data do not indicate that the VOCs migrating from the Charleston Air Force Base property has not adversely impacted the Naval Annex. Review of the geoprobe data provided in the facility's geographic information system (GIS) database, indicates that low concentrations of VOCs, to include methyl isobutyl ketone, are present at the northern boundary between the Naval Annex and the Charleston Air Force Base property. The Navy should monitor groundwater quality at the northern boundary to determine the quality of groundwater migrating onto the Naval Annex from the Charleston Air Force Base property.

CH2M-Jones Response:

There are some indications from the analytical results of the investigations conducted by EnSafe within the Charleston Air Force Base (AFB) property and conducted by CH2M-Jones on Navy property near the Charleston AFB property that CVOCs are migrating into Zone K. Although the findings summarized in the Zone K RFI Offsite Groundwater Sampling Technical Memorandum (EnSafe, 2001) by the Navy/EnSafe team did not identify a source of low-level chlorinated solvents in groundwater on the Charleston AFB, there are indications that there may be a VOC plume migrating onto Navy property in deep groundwater from the Charleston AFB. CH2M-Jones will be proposing some additional groundwater sampling to confirm whether such a plume is migrating on site.

Two detections of TCE above its MCL in DPT samples from KGDKGP022 and KGDKGP023 on the northwestern boundary of Zone K have been included as part of the dissolved plume boundary shown in Figure 4-3 of the RFI Report Addendums for both SWMU 163 and SWMU 166 and will be addressed as part of the CMS for this site. The TCE detections at these two locations (22 µg/L and 16.1 µg/L) indicate low-level contamination and do not warrant installation of additional monitoring wells. The Navy/CH2M-Jones team feels that the extent of the dissolved TCE plume near the Charleston AFB boundary has been adequately characterized for the scope of the RFI, and the installation of additional monitoring wells near the northern boundary is not warranted.

Comment:

8. Rate Of Groundwater Flow
Overcash Comment 7

The Navy states that in the Zone K RFI Report (EnSafe, June 1999), the shallow and deep groundwater velocities at the Naval Annex were calculated at 5.9 and 2.2 feet per day, respectively. However, according to Table 2.13 of the referenced Report, these values are given as hydraulic conductivity and not velocity. The velocities reported on Table 2.13 are 0.174 feet per day for the shallow aquifer and 0.044 feet per day for the deeper portion of the uppermost aquifer. The Navy must re-calculate groundwater velocity for the shallow and deep portions of the aquifer based on current data.

CH2M-Jones Response:

Groundwater velocities are calculated using site-specific values for horizontal hydraulic gradient, porosity, and hydraulic conductivity. Table 2.13 provided in the Zone K RFI

Report (EnSafe, June 1999) summarizes the calculated hydraulic gradient and groundwater velocity values for both the shallow and deep portions of the surficial aquifer.

Groundwater velocities were recalculated using the most recent groundwater elevation data collected in February 2002. This groundwater elevation data, as presented in Table 2-1 of the RFI Report Addendums for both SWMU 163 and SWMU 166, were used to calculate hydraulic gradients. Aquifer porosity and hydraulic conductivity values provided in the Zone K RFI Report (EnSafe, June 1999) were used in the revised calculation since these parameters have not been further investigated since the initial RFI field activities completed by EnSafe in 1996 through 1998. The revised groundwater velocities, presented in Table 2-2, are similar to the values presented in Table 2.13 of the Zone K RFI Report (EnSafe, June 1999) because the gradients and elevations from each data collection event, when compared to each other, are similar.

Comment:

9. Data Presentation

Overcash Comment 10

The Navy has proposed to sort the data presented on Tables 4-1, 4-2, and C-1 of the SWMU 163 document and on Tables 4-2 through 4-5 of the SWMU 166 document "by an alphabetical listing of contaminants, followed by an ascending order of station location and sample collection interval." As the collection depth interval is not included on existing Table 4-1 and Table 4-2 of the SWMU 163 document, it is assumed from the Navy's response that a column with depth information will be added to those Tables. Also, it is unclear as to whether sorting of the data would be beneficial to Table C-1 entitled Analytical Data Summary.

The Navy further responded that Figures 4-2 through 4-7 of the SWMU 163 document and Figures 4-2 through 4-5 of the SWMU 166 document would be revised to present groundwater data from the two most recent sampling events. This Division does not agree with this proposed change. Rather, the data already included on the Figures and any new data should be presented in a logical manner. In other words, the data presented on the Figures should:

- Add the date of the geoprobe and vertical profiler data to the legend;
- Geoprobe/vertical profiler/multiple screened well data should continue to be presented in descending order, from land surface to below land surface;
- Present permanent monitoring well data in chronological order so that any trends/zones of contamination may be more easily recognized.

Considering the complexity of the groundwater flow regime, the numerous data points and sampling events, this Division strongly recommends that the Navy not only present the data as outlined above, but that the Navy group data from the various depth intervals where contaminants have been detected and present that data by means of, for instance, cross sections, plane map views, tables, etc. Emphasis should be given to any identified flow paths as the Navy has rightly pointed out in response to Comment 15.

Additionally, data from permanent monitoring locations could be presented through time-trend analysis.

CH2M-Jones Response:

Data Presentation – Tables

Sample collection depth intervals will be added to Tables 4-1 and 4-2 in the RFI Report Addendum, Revision 0, SWMU 163, Zone K (CH2M-Jones, March 2002). The data presented in these tables, along with the data presented in Tables 4-2 through 4-5 from the RFI Report Addendum, Revision 0, SWMU 166, Zone K (CH2M-Jones, January 2002), will be sorted by an alphabetical listing of contaminants, followed by an ascending order of station location and sample collection interval.

The Navy agrees with SCDHEC on the relevance of sorting data in Table C-1 from the RFI Report Addendum, Revision 0, SWMU 163, Zone K (CH2M-Jones, March 2002). Modifications to data summary tables provided in Appendix C of the RFI Report Addendums, Revision 0, for both SWMU 163 and SWMU 166 only include presenting sample collection depths from geoprobe and vertical profiler points in both ft bls and ft msl. Survey data were not available, and as a result, data from EnSafe's offsite investigation at the Charleston AFB (Table 4-4 of the RFI Report Addendum, Revision 0, SWMU 166, Zone K [CH2M-Jones, January 2002]) are presented as a function of ft bls.

Data Presentation – Figures

Figures 4-2 through 4-7 provided in the RFI Report Addendum, Revision 0, SWMU 163, Zone K (CH2M-Jones, March 2002) and Figures 4-2 through 4-5 provided in the RFI Report Addendum, Revision 0, SWMU 166, Zone K (CH2M-Jones, January 2002) will be modified to show sample collection depths of geoprobe and vertical profiler point samples in ft msl instead of ft bls. Data from the geoprobe and vertical profiler points will be presented in a descending order, from land surface to bls.

Monitoring well data from the two most recent sampling events, with the most recent event data at the top immediately below the station identification, will be presented in these figures. Due to space limitations on these E-Size figures (33 by 44 inches) the geoprobe and vertical profiler point sample collection data and the complete historical sample collection data from each monitoring well cannot be presented.

An appendix will be added to the Revision 1 RFI Report Addendum for SWMU 166 that presents time trend analysis of select monitoring wells from the site.

Comment:

10. Isoconcentration Contours

Overcash Comment 12

The portion of the Comment regarding the isoconcentration contour of 10 µg/L on Figure 4-3 of the SWMU 163 document has been omitted and therefore has not been addressed. Also, clarify that all isoconcentration contours will be verified, not just the two pointed out during this review.

CH2M-Jones Response:

All isoconcentration contours depicted on Figures 4-2 through 4-7 provided in the RFI Report Addendum, Revision 0, SWMU 163, Zone K (CH2M-Jones, March 2002) and

Figures 4-2 through 4-5 provided in the RFI Report Addendum, Revision 0, SWMU 166, Zone K (CH2M-Jones, January 2002) will be redrawn due to the availability of new data. These revised contour lines will be verified by senior project staff.

The 100 µg/L isoconcentration line on Figure 4-3 in the RFI Report Addendums, Revision 0, for both SWMU 163 and SWMU 166 will be redrawn so that K166GP102, K166GP103, and K166GP104 are located between the 10 and 100 µg/L contour lines. This contradicts the Navy's response to Ms. Overcash's Comment 12 from the January 31, 2003 Responses to Comments. Groundwater data collected from deep monitoring wells K166GW04D (September 1998), K166GW12D (September 1998), and K166GW08D (July 2002) were used to draw both the 10 and 100 µg/L contour lines in this area. Even though geoprobe points K166GP102, K166GP103 and K166GP104 are located between these three wells, generally data from monitoring well samples are more representative of the surficial aquifer than samples collected from a geoprobe. Because of this, data collected from these geoprobe points in this area of the site were not used in the isoconcentration contour evaluation.

Comment:

11. Comprehensive Zone K Naval Annex

Bergstrand 16

As noted in the introductory remarks, the Navy has chosen to use the "SWMU 166" identification for all the groundwater VOC plume across the Zone K Naval Annex. While the Navy should continue the RFI process for SWMU 163 and SWMU 166 separately by revising each of the referenced RFI Reports Addendum, it may be prudent to submit one comprehensive CMS for groundwater at Zone K Naval Annex.

CH2M-Jones Response:

The Navy agrees with SCDHEC and will prepare and submit one comprehensive CMS for groundwater at the Zone K Naval Annex. The CMS will be prepared after the RFI Report Addendum is completed and the effectiveness of the IMs have been evaluated.

Comment:

12. Monitoring Well Logs

Bergstrand 19

This reviewer was unable to locate copies of monitoring well logs for K166GW42D and K166GW43D. These logs would aid in determining the relationship of the wells to the top of the Ashley Formation. Please provide.

CH2M-Jones Response:

Monitoring well logs for K166GW42D and K166GW43D are included with this responses to comments document.

Comment:

13. Maps

Bergstrand 24

The Navy's response to this Comment is contradicted by the Navy's response to Bergstrand Comment 21 and the response to Overcash Comment 1. The Navy must revise the RFIRA documents to include lithologic/geologic cross sections, revised

isoconcentration maps, a contour map of the top of the Ashley Formation, and any other figures, as proposed in response to this review.

CH2M-Jones Response:

The Navy agrees with SCDHEC and will revise the RFI Report Addendums for both SWMU 163 and 166 to include lithologic/geologic cross sections, revised isoconcentration maps, and a contour map of the top of the Ashley Formation.

Comment:

14. Specific Comments Conclusions

(Numbers do not correspond to Comments)

1. Provide a number of geologic cross sections of the Zone K Naval Annex. Orientation must be parallel and perpendicular to groundwater flow and consideration must be given to the 8 TTAs.

CH2M-Jones Response:

Three lithologic cross sections of the Naval Annex will be constructed using well log geologic descriptions of the subsurface collected during the original RFI activities and new geologic data collected subsequent to the Zone K RFI Report (EnSafe, June 1999). These lithologic cross sections will be included as Figures 2-1 through 2-3 in the Revision 1 RFI Report Addendums for both SWMU 163 and SWMU 166.

2. Submit a monitoring well installation request for those wells to be installed in the southwestern portion of the Naval Annex within ten days of receipt of this correspondence.

CH2M-Jones Response:

In a July 21, 2003 letter addressed to Ms. Jo Cherie Overcash, CH2M-Jones requested the installation of two deep groundwater monitoring wells in the southwestern portion of the Naval Annex. These proposed monitoring well locations, identified as KGDKGW03D and KGDKGW04D, are designed to evaluate potential offsite migration of chlorinated solvents near the southwestern property boundary. SCDHEC subsequently approved the request in a letter dated July 31, 2003.

3. Identify monitoring locations in the southeastern portion of the site for delineation and for long-term monitoring. Identification of these wells should be made along with the request to install additional monitoring wells in the southwestern portion of the Naval Annex.

CH2M-Jones Response:

For the shallow aquifer on the southeastern side of the SWMU 166 area, wells K166GW004, K166GW008 and K166GW017 are adequate to monitor the threat of offsite contaminant migration from SWMU 166, since the contaminant source areas related to SWMU 166 are upgradient of these wells.

For the deeper aquifer on the southeastern side of the SWMU 166 area, wells K166GW04D, K166GW08D, K166GW11D, K166GW12D and K166GW17D are adequate to monitor the threat of offsite contaminant migration from SWMU 166.

4. Re-evaluate groundwater quality at the northern boundary to determine groundwater quality migrating onto the Naval Annex from the Charleston Air Force property.

CH2M-Jones Response:

Additional groundwater investigation activities will be proposed to further evaluate this issue.

5. Recalculate shallow and deep groundwater velocities based on current data.

CH2M-Jones Response:

Groundwater velocities were recalculated using the most recent groundwater elevation data collected in February 2002. The revised groundwater velocities, presented in Table 2-2, will be provided in the Revision 1 RFI Report Addendums for both SWMU 163 and SWMU 166.

6. Add depth intervals to Tables 4-1 and 4-2 of the SWMU 163 document; add geoprobe and vertical profiler dates to the legends of the appropriate Figures of both documents; sort permanent monitoring well data by dates; provide additional figures, tables to depict zones of specific interest.

CH2M-Jones Response:

Sample collection depth intervals will be added to Tables 4-1 and 4-2 from the RFI Report Addendum, Revision 0, SWMU 163, Zone K (CH2M-Jones, March 2002). Geoprobe and vertical profiler point sample collection dates and the complete historical sample collection data from each monitoring well cannot be presented on the isoconcentration figures (Section 4 of the RFI Report Addendums for SWMU 163 and SWMU 166) due to the lack of space.

7. Verify isoconcentration contours 10 µg/L, 100 µg/L and the remaining contours on the Figures.

CH2M-Jones Response:

All isoconcentration contours depicted on Figures 4-2 through 4-7 provided in the RFI Report Addendum, Revision 0, SWMU 163, Zone K (CH2M-Jones, March 2002) and Figures 4-2 through 4-5 provided in the RFI Report Addendum, Revision 0, SWMU 166, Zone K (CH2M-Jones, January 2002) will be redrawn due to the availability of new data. These revised contour lines will be verified by senior project staff.

8. Provide the installation logs for K166GW42D and K166GW43D.

CH2M-Jones Response:

Monitoring well logs for K166GW42D and K166GW43D are enclosed with this response to comment document.

Comments Prepared by Jerry Stamps, P.G., July 3, 2003

1. Response to Comment 3

Given the uncertainty regarding past use of the in-ground tank near building 2513, the Department recommends collecting samples around this tank to verify if a release has occurred. Furthermore, the soils samples collected in this area are approximately 10 or more feet away from the tank; therefore, the results of this sampling would not be representative of a potential release from the tank

CH2M-Jones Response:

The surface and subsurface soils in the area of the in-ground tank near Building 2513 will be investigated during the upcoming RFI field activities at SWMU 197 (Building 2532, an old paint storage shed, and a swale on the west of Building 2532) and SWMU 198 (a concrete slab used as a satellite accumulation area on the south side of 6th Street across from Building 2532). The proposed investigation activities will be outlined in a sampling and analysis plan.



CH2MHILL

PROJECT NUMBER
158814.ZK.EX.07

WELL NUMBER
166GW042D

SHEET 1 OF 1

WELL COMPLETION DIAGRAM

PROJECT : SWMU 166, Zone K, Charleston Naval Complex

LOCATION : Charleston, South Carolina

DRILLING CONTRACTOR : Prosonic Corporation License # 1435

NORTHING: 388154.7

DRILLING METHOD AND EQUIPMENT USED : Hollow stem augers (7 1/4-inch outside diameter)

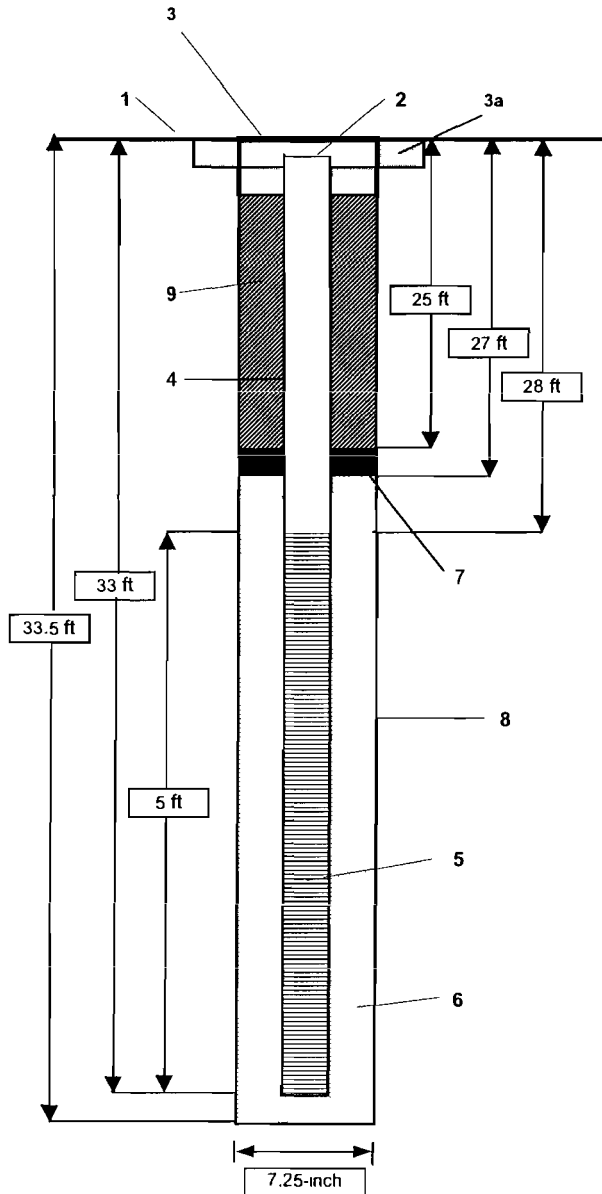
EASTING: 2300362.2

WATER LEVELS : 31.6

START : 5/14/2002

END: 5/14/2002

LOGGER : David Beverly



1- Ground elevation at well	41.2
2- Top of casing elevation	40.83
3- Protective cover type	8-inch dia flush mount manhole vault
a) concrete pad dimensions	2 ft x 2 ft x 6-inches deep
4- Dia./type of well casing	2-inch inside diameter schedule 40 PVC
5- Type/slot size of screen	0.010-inch dia. machine slotted PVC
6- Type filter pack	20/40 Sieve Size Silica Sand
7- Type of seal	3/8-inch bentonite chips
8- Borehole diameter	7.25-inch
9- Grout	Bentonite grout

Note: Diagram not to scale.



CH2MHILL

PROJECT NUMBER
158814.ZK.EX.07

WELL NUMBER
166GW043D

SHEET 1 OF 1

WELL COMPLETION DIAGRAM

PROJECT : SWMU 166, Zone K, Charleston Naval Complex

LOCATION : Charleston, South Carolina

DRILLING CONTRACTOR : Prosonic Corporation License # 1435

NORTHING: 388111.3

DRILLING METHOD AND EQUIPMENT USED : Rotosonic (standard 4- and 6-inch casings)

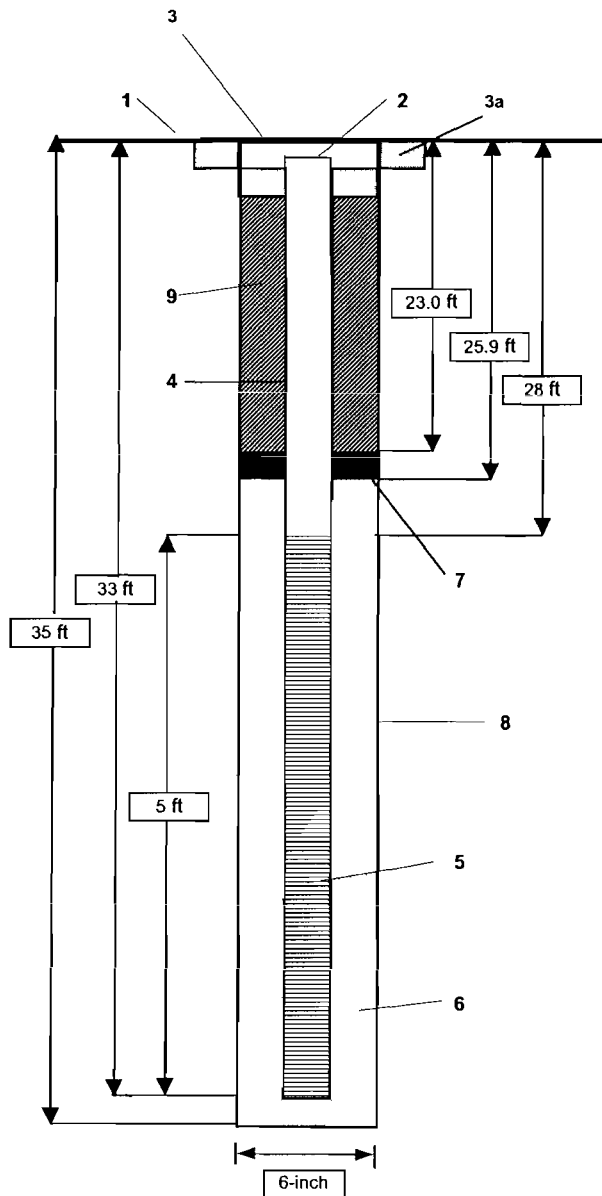
EASTING: 2300361.5

WATER LEVELS : 33.2

START : 5/14/2002

END: 5/14/2002

LOGGER : David Beverly



1- Ground elevation at well	41.40
2- Top of casing elevation	41.12
3- Protective cover type	8-inch dia. flush mount manhole vault
a) concrete pad dimensions	2 ft x 2 ft x 6-inches deep
4- Dia./type of well casing	2-inch inside diameter schedule 40 PVC
5- Type/slot size of screen	0.010-inch dia. machine slotted PVC
6- Type filter pack	20/40 Sieve Size Silica Sand
7- Type of seal	3/8-inch bentonite pellets
8- Borehole diameter	6-inch
9- Grout	Bentonite grout

Note: Diagram not to scale.